What is claimed is:

1. A method for controlling the capacity of a multiple compressor chiller system, the method comprising the steps of:

providing a variable speed drive having a plurality of inverters, wherein each inverter is configured to power a corresponding compressor motor of a multiple compressor chiller system;

monitoring at least one operating condition of a multiple compressor chiller system;

determining whether to increase output capacity of a multiple compressor chiller system in response to the at least one monitored operating condition;

adjusting an operating configuration of the plurality of inverters to increase the output capacity of a multiple compressor chiller system in response to a determination to increase output capacity;

determining whether to decrease output capacity of a multiple compressor chiller system in response to the at least one monitored operating condition; and

adjusting an operating configuration of the plurality of inverters to decrease the output capacity of a multiple compressor chiller system in response to a determination to decrease output capacity.

2. The method of claim 1 further comprising the steps of:

determining whether to start a predetermined number of inverters of the plurality of inverters in response to the at least one monitored operating condition; and

starting the predetermined number of inverters of the plurality of inverters in response to a determination to start the predetermined number of compressors.

3. The method of claim 2 wherein the step of starting the predetermined number of inverters of the plurality of inverters includes the steps of:

determining whether the plurality of inverters are inactive;

determining whether a chilled liquid temperature is greater than a setpoint temperature plus an offset temperature; and

determining the predetermined number of inverters of the plurality of inverters to start in response to a determination that the plurality of inverters are

inactive and a determination that a chilled liquid temperature is greater than a setpoint temperature plus an offset temperature.

4. The method of claim 3 wherein the step of starting the predetermined number of inverters of the plurality of inverters includes the step of starting the predetermined number of inverters at a predetermined frequency.

5. The method of claim 4 wherein the predetermined frequency is a frequency between about 15 Hz and about 75 Hz.

6. The method of claim 5 wherein the predetermined frequency is about 40 Hz.

7. The method of claim 5 wherein:

the setpoint temperature is a temperature between about 15 °F and about 55 °F; and

the offset temperature is a temperature between about ± 1 °F and about ± 5 °F.

8. The method of claim 1 wherein the step of adjusting an operating configuration of the plurality of inverters to increase the output capacity of a multiple compressor chiller system includes the step of determining whether any inverter of the plurality of inverters is inactive.

9. The method of claim 8 wherein the step of adjusting an operating configuration of the plurality of inverters to increase the output capacity of a multiple compressor chiller system further includes the step of determining if an inverter operating frequency for the plurality of inverters is greater than a stop frequency plus a predetermined offset frequency.

10. The method of claim 9 wherein the step of adjusting an operating configuration of the plurality of inverters to increase the output capacity of a multiple compressor chiller system further includes the step of starting an additional inverter of the plurality of inverters in response to a determination that any inverter of the plurality of inverters is inactive and a determination that an inverter operating frequency for the plurality of inverters is greater than a stop frequency plus a predetermined offset frequency.

11. The method of claim 10 wherein the step of starting an additional inverter of the plurality of inverters includes the step of configuring operating inverters of the plurality of inverters to operate at a predetermined frequency.

12. The method of claim 11 wherein the predetermined frequency is the inverter operating frequency multiplied by a ratio of a number of operating inverters divided by the number of operating inverters plus one.

13. The method of claim 9 wherein the stop frequency is a minimum inverter frequency multiplied by a ratio of a number of operating inverters plus one divided by the number of operating inverters.

14. The method of claim 12 wherein:

the minimum inverter frequency is a frequency between about 15 Hz and about 75 Hz; and

the predetermined offset frequency is a frequency between about 0 Hz and about 50 Hz.

15. The method of claim 8 wherein the step of adjusting an operating configuration of the plurality of inverters to increase the output capacity of a multiple compressor chiller system further includes the step of determining whether an inverter operating frequency is less than a maximum inverter frequency.

16. The method of claim 15 wherein the step of adjusting an operating configuration of the plurality of inverters to increase the output capacity of a multiple compressor chiller system further includes the step of increasing the inverter operating frequency by a predetermined frequency amount in response to a determination that no inverter of the plurality of inverters is inactive and a determination that an inverter operating frequency is less than a maximum inverter frequency.

17. The method of claim 16 wherein the predetermined frequency amount is a frequency between about 0.1 Hz and about 25 Hz.

18. The method of claim 9 wherein the step of adjusting an operating configuration of the plurality of inverters to increase the output capacity of a multiple compressor chiller system further includes the step of increasing the inverter operating frequency by a predetermined frequency amount in response to a determination that any inverter of the plurality of inverters is inactive and a determination that an inverter operating frequency of the plurality of inverters is not greater than a stop frequency plus a predetermined offset frequency.

19. The method of claim 1 wherein the step of adjusting an operating configuration of the plurality of inverters to decrease the output capacity of a multiple compressor chiller

system includes the step of determining whether only one inverter of the plurality of inverters is operating.

20. The method of claim 19 wherein the step of adjusting an operating configuration of the plurality of inverters to decrease the output capacity of a multiple compressor chiller system further includes the step of determining if an inverter operating frequency is greater than a minimum inverter frequency.

21. The method of claim 20 wherein the step of adjusting an operating configuration of the plurality of inverters to decrease the output capacity of a multiple compressor chiller system further includes the step of determining whether a chilled liquid temperature is less than a setpoint temperature minus an offset temperature.

22. The method of claim 21 wherein the step of adjusting an operating configuration of the plurality of inverters to decrease the output capacity of a multiple compressor chiller system further includes the step of stopping the only one operating inverter of the plurality of inverters in response to a determination that only one inverter of the plurality of inverters is operating, a determination that an inverter operating frequency is not greater than a minimum inverter frequency, and a determination that a chilled liquid temperature is less than a setpoint temperature minus an offset temperature.

23. The method of claim 22 wherein:

the minimum inverter frequency is a frequency between about 15 Hz and about 75 Hz;

the setpoint temperature is a temperature between about 15 °F and about 55 °F; and

the offset temperature is a temperature between about ± 1 °F and about ± 5 °F.

24. The method of claim 19 wherein the step of adjusting an operating configuration of the plurality of inverters to decrease the output capacity of a multiple compressor chiller system further includes the step of determining if an inverter operating frequency is substantially equal to a minimum inverter frequency.

25. The method of claim 24 wherein the step of adjusting an operating configuration of the plurality of inverters to decrease the output capacity of a multiple compressor chiller system further includes the step of stopping an operating inverter of the plurality of inverters in response to a determination that more than one inverter of the plurality of

inverters is operating and a determination that an inverter operating frequency is equal to a minimum inverter frequency.

26. The method of claim 25 wherein the step of stopping an operating inverter of the plurality of inverters includes the step of configuring the remaining operating inverters of the plurality of inverters to operate at a predetermined frequency.

27. The method of claim 26 wherein the predetermined frequency is a minimum inverter frequency multiplied by a ratio of the remaining operating inverters plus one divided by the remaining operating inverters.

28. The method of claim 27 wherein the minimum inverter frequency is a frequency between about 15 Hz and about 75 Hz.

29. The method of claim 20 wherein the step of adjusting an operating configuration of the plurality of inverters to decrease the output capacity of a multiple compressor chiller system further includes the step of decreasing the inverter operating frequency by a predetermined frequency amount in response to a determination that only one inverter of the plurality of inverters is operating and a determination that an inverter operating frequency is greater than a minimum inverter frequency.

30. The method of claim 29 wherein the predetermined frequency amount is a frequency between about 0.1 Hz and about 25 Hz and the inverter minimum frequency is a frequency between about 15 Hz and about 75 Hz.

31. The method of claim 24 wherein the step of adjusting an operating configuration of the plurality of inverters to decrease the output capacity of a multiple compressor chiller system further includes the step of decreasing the inverter operating frequency by a predetermined frequency amount in response to a determination that more than one inverter of the plurality of inverters is operating and a determination that an inverter operating frequency is not equal to a minimum inverter frequency.

32. A multiple compressor chiller system comprising:

a plurality of compressors, each compressor of the plurality of compressors being driven by a corresponding motor, the plurality of compressors being incorporated into at least one refrigerant circuit, each refrigerant circuit comprising at least one compressor of the plurality of compressors, a condenser arrangement and an evaporator arrangement connected in a closed refrigerant loop;

a variable speed drive to power the corresponding motors of the plurality of compressors, the variable speed drive comprising a converter stage, a DC link stage and an inverter stage, the inverter stage having a plurality of inverters each electrically connected in parallel to the DC link stage and each powering a corresponding motor of the plurality of compressors; and

a control panel to control the variable speed drive to generate a preselected system capacity from the plurality of compressors, the control panel being configured to determine a number of inverters of the plurality of inverters to operate in the variable speed drive and configured to determine an operating frequency for the number of operating inverters of the plurality of inverters in the variable speed drive to generate the preselected system capacity from the plurality of compressors.

33. The multiple compressor chiller system of claim 32 wherein the control panel comprises means for enabling a predetermined number of inverters of the plurality of inverters in response to a start control signal and satisfying at least one predetermined start criteria.

34. The multiple compressor chiller system of claim 33 wherein the at least one predetermined start criteria comprises at least one of:

the plurality of inverters being inactive; and

a chilled liquid temperature being greater than a setpoint temperature plus an offset temperature.

35. The multiple compressor chiller system of claim 34 wherein the means for enabling a predetermined number of inverters includes means for operating the predetermined number of inverters at a predetermined frequency.

36. The multiple compressor chiller system of claim 32 wherein the control panel comprises means for adjusting the operating frequency of the plurality of inverters of the variable speed drive in response to satisfying at least one predetermined capacity criteria, means for enabling a non-operating inverter of the plurality of inverters in response to satisfying at least one predetermined enabling criteria, and means for disabling an operating inverter of the plurality of inverters in response to satisfying at least one predetermined disabling criteria.

37. The multiple compressor chiller system of claim 36 wherein:

the means for adjusting the operating frequency of the plurality of inverters of the variable speed drive comprises means for increasing the operating frequency of the plurality of inverters by a predetermined frequency amount; and

the at least one predetermined capacity criteria comprises at least one of:

an increase capacity control signal;

any inverter of the plurality of inverters being disabled;

an inverter operating frequency being less than a maximum inverter frequency;

all inverters of the plurality of inverters being enabled; and

an inverter operating frequency for the plurality of inverters being less than a stop frequency plus a predetermined offset frequency.

38. The multiple compressor chiller system of claim 37 wherein the predetermined frequency amount is a frequency between about 0.1 Hz and about 25 Hz.

39. The multiple compressor chiller system of claim 36 wherein:

the means for adjusting the operating frequency of the plurality of inverters of the variable speed drive comprises means for decreasing the operating frequency of the plurality of inverters by a predetermined frequency amount; and

the at least one predetermined capacity criteria comprises at least one of:

a decrease capacity control signal;

more than one inverter of the plurality of inverters being enabled;

an inverter operating frequency being not equal to a minimum inverter frequency;

only one inverter of the plurality of inverters being enabled; and

an inverter operating frequency being greater than a minimum inverter frequency.

40. The multiple compressor chiller system of claim 39 wherein the predetermined frequency amount is a frequency between about 0.1 Hz and about 25 Hz.

41. The multiple compressor chiller system of claim 36 wherein the at least one predetermined enabling criteria comprises at least one of:

an increase capacity control signal;

any inverter of the plurality of inverters being disabled; and

an inverter operating frequency for the plurality of inverters being greater than a stop frequency plus a predetermined offset frequency.

42. The multiple compressor chiller system of claim 36 wherein the at least one predetermined disabling criteria comprises at least one of:

a decrease capacity control signal;

more than one inverter of the plurality of inverters being enabled;

an inverter operating frequency being equal to a minimum inverter frequency;

only one inverter of the plurality of inverters being enabled;

an inverter operating frequency being less than a minimum inverter frequency; and

a chilled liquid temperature being less than a setpoint temperature minus an offset temperature.

43. A capacity control method for a multiple compressor chiller system, the method comprising the steps of:

providing a variable speed drive having a plurality of inverters, wherein each inverter is configured to power a corresponding compressor motor of a multiple compressor chiller system at a preselected output frequency;

monitoring at least one operating condition of a multiple compressor chiller system;

determining whether to increase capacity in the multiple compressor chiller system in response to the at least one monitored operating condition;

configuring the plurality of inverters to generate increased capacity in the multiple compressor chiller system in response to a determination to increase capacity, wherein the step of configuring the plurality of inverters to generate increased capacity includes:

determining whether to enable an additional inverter of the plurality of inverters in order to start an additional compressor motor of the multiple compressor chiller system;

enabling an additional inverter of the plurality of inverters in response to a determination to enable an additional inverter; and

adjusting the preselected output frequency of each operating inverter of the plurality of inverters;

determining whether to decrease capacity in the multiple compressor chiller system in response to the at least one monitored operating condition; and

configuring the plurality of inverters to generate decreased capacity in the multiple compressor chiller system in response to a determination to decrease capacity, wherein the step of configuring the plurality of inverters to generate decreased capacity includes:

determining whether to disable an operating inverter of the plurality of inverters in order to stop a compressor motor of the multiple compressor chiller system;

disabling an operating inverter of the plurality of inverters in response to a determination to disable an operating inverter; and

decreasing the preselected output frequency of each operating inverter of the plurality of inverters.

44. The capacity control method of claim 43 further comprising the steps of:

determining whether to start a predetermined number of inverters of the plurality of inverters in response to the at least one monitored operating condition; and

starting the predetermined number of inverters of the plurality of inverters in response to a determination to start the predetermined number of compressors.

45. The capacity control method of claim 44 wherein the step of starting the predetermined number of inverters of the plurality of inverters includes the steps of:

determining whether the plurality of inverters are disabled;

determining whether a chilled liquid temperature is greater than a setpoint temperature plus an offset temperature; and

determining the predetermined number of inverters of the plurality of inverters to start in response to a determination that the plurality of inverters are disabled and a determination that a chilled liquid temperature is greater than a setpoint temperature plus an offset temperature.

46. The capacity control method of claim 45 wherein the step of starting the predetermined number of inverters of the plurality of inverters includes the step of operating the predetermined number of inverters at a predetermined frequency.

47. The capacity control method of claim 43 wherein the step of determining whether to enable an additional inverter of the plurality of inverters includes the steps of:

determining whether any inverter of the plurality of inverters is disabled; and

determining whether an inverter operating frequency for the plurality of inverters is greater than a stop frequency plus a predetermined offset frequency.

48. The capacity control method of claim 43 wherein the step of adjusting the preselected output frequency of each operating inverter of the plurality of inverters includes the steps of:

determining whether any inverter of the plurality of inverters is disabled;

determining whether an inverter operating frequency of the plurality of inverters is less than a stop frequency plus a predetermined offset frequency; and

increasing the inverter operating frequency by a predetermined frequency amount in response to a determination that any inverter of the plurality of inverters is disabled and a determination that an inverter operating frequency of the plurality of inverters is less than a stop frequency plus a predetermined offset frequency.

49. The capacity control method of claim 43 wherein the step of determining whether to disable an operating inverter of the plurality of inverters includes the steps of:

determining whether only one inverter of the plurality of inverters is enabled;

determining whether an inverter operating frequency is less than a minimum inverter frequency; and

determining whether a chilled liquid temperature is less than a setpoint temperature minus an offset temperature.

50. The capacity control method of claim 43 wherein the step of decreasing the preselected output frequency of each operating inverter of the plurality of inverters includes the steps of:

determining whether only one inverter of the plurality of inverters is enabled;

determining whether an inverter operating frequency is greater than a minimum inverter frequency; and

decreasing the inverter operating frequency by a predetermined frequency amount in response to a determination that only one inverter of the plurality of inverters is operating and a determination that an inverter operating frequency is greater than a minimum inverter frequency.

51. The capacity control method of claim 43 wherein the step of adjusting the preselected output frequency of each operating inverter of the plurality of inverters includes the steps of:

determining whether all inverters of the plurality of inverters are enabled;

determining whether an inverter operating frequency is less than a maximum inverter frequency; and

increasing the inverter operating frequency by a predetermined frequency amount in response to a determination that all inverters of the plurality of inverters are enabled and a determination that an inverter operating frequency is less than a maximum inverter frequency.

52. The capacity control method of claim 43 wherein the step of determining whether to disable an operating inverter of the plurality of inverters includes the steps of:

determining whether more than one inverter of the plurality of inverters is enabled; and

determining whether an inverter operating frequency is equal to a minimum inverter frequency.

53. The capacity control method of claim 43 wherein the step of decreasing the preselected output frequency of each operating inverter of the plurality of inverters includes the steps of:

determining whether more than one inverter of the plurality of inverters is enabled;

determining whether an inverter operating frequency is not equal to a minimum inverter frequency; and

decreasing the inverter operating frequency by a predetermined frequency amount in response to a determination that more than one inverter of the plurality of inverters is enabled and a determination that an inverter operating frequency is not equal to a minimum inverter frequency.